Office of Technical Assistance Research Proposal

A Substitute for Powdered Zinc Stearate as an External Lubricant in Polystyrene Pellet Production

Background:

Manufacturers of polystyrene resins produce them in a series of polymerization reactors with the final product being a resin in pellet form. These pellets are sold in 55-pound bags, 1000 lbs. boxes or in bulk trucks (45,000 lbs.) or bulk railcars (200,000 lbs.). All manufacturers of polystyrene resin use an external lubricant on the outside of the pellets that is added in the last step of the production process. The purpose of the external lubricant is threefold; (1) to make the pneumatic transfer and conveying of these resins much easier during production, (2) to prevent their adhering to each other during storage and transport and (3) the lubricity added by this compound makes the injection molding of the various finished goods by their customers easier.

Scope of Problem:

Powdered zinc stearate is frequently used as the lubricant for both plastic resin pellets. The zinc stearate is a very effective lubricant and has been in use for several years. Manufacturers also use a variety of similar lubricants for their resins including Acrawax C and Kemamide W-40, also in the dust form. There is however a downside to the use of any of these dusty products; among them being product loss (of the lubricant), they create a housekeeping nightmare, and there is also a problem since the dust clogs other equipment in the plant. Even though the zinc stearate is FDA approved, there is also the concern of employee health and industrial hygiene, due to the inhalation of particulates. Zinc stearate is a TRI and TURA listed and reportable chemical. It is true that a switch to a non-TURA dry chemical could be made, but we still would have the same dusty, housekeeping, maintenance and worker health problems associated with it.

This sector in Massachusetts competes with some very large producers, both out-of-state and in the world as well. In order to remain competitive, raw material costs must obviously be kept to a minimum. There were five companies in the sector that are TURA filers (SIC 282x), collectively using a total of 390,000 pounds of the material, based upon the 1999 TURA data. There are potentially 38 more companies in the state that may use this compound but would use it below reporting thresholds.

Work Performed to Date:

In an effort to keep an external lubricant on the resins, yet to eliminate the downside of the dust, some companies began to research alternatives to the zinc stearate. There are a variety of acceptable external lubricants that suppliers have put into an emulsion format simply by adding the lubricant to water along with an emulsifying agent. Some pellet manufacturers have looked at a variety of these commercially available liquid lubricants and found then to be an acceptable alternative to the dry, dusty zinc stearate. Trials have been successfully run at plants and the resin produced yielded an acceptable product with the liquid lubricant.

The primary problem with the liquid lubricants is that of cost. Most of the emulsions are 30-35% lubricant with the balance of the product being water. A very small amount (under 1%) of emulsifying agent has been added to the product to keep it suspended. On a dry weight basis of comparison, the liquid lubricant is 3 - 4 times the cost of the equivalent weight of dry product (the water is simply evaporated during the addition process, leaving the lubricant on the pellets).

Some plastic pellet producers have tried producing their own emulsion from dry Kemamide W-40 and/or dry Acrawax C, commercially available products, but this had failed after several attempts. This is primarily due to an inability to locate an effective emulsifying agent and many of these companies do not have an R & D department, which would ordinarily perform the research and develop such an alternative lubricant. Both the liquid Kemamide and Acrawax formulas contain about 65% water with a very small amount of FDA approved emulsifiers.

Objective:

An examination of both powdered zinc stearate, as well as commercially available alternatives to examine the properties, including lubricity of the plastic pellets after the application of these materials needs to be done. Next, those parameters that are critical to the makeup of an effective material to meet the performance needs of resin pellet manufacturers and their customers must be identified. Developing a solution that would then incorporate those desirable characteristics into it would then need to be accomplished. Finally, testing and evaluation in concert with an industry partner would be needed. A good candidate for an industry partner is known and is willing to participate in this regard.